

HYDRAULIC COILED TUBING JAR

Instruction Manual 4500



Hydraulic Up/Down Coiled Tubing Jar



Hydraulic Coiled Tubing Jar

INDEX

Hydraulic Up/Down Coiled Tubing Jar

Introduction

- How this Manual is Organized
- Conventions and Measurements

Section 1: General Description 4

Section 2: Application

- Important Information 4
- General Guidelines for Coiled Tubing Fishing 5

Section 3: Operation

- Preparation 5
- Rig Up 5
- Running Procedure Guidelines 5
- Up Jar Operation 5
- Down Jar Operation 5
- Troubleshooting 5
- Rig Down 6

Section 4: Maintenance

- Rig Floor Maintenance 6
- Dressing Area Maintenance 6
- Equipment 6

Section 5: Disassembly

- Disassembly Notes 6
- Complete Disassembly 7

Section 6: Inspection

- Inspection Notes 8
- Inspection and Repair Procedures 8

Section 7: Assembly

- Assembly Notes 9
- Pre-Assembly 9
- Main Assembly 10

Section 8: Filling the Coiled Tubing Jar 12

Section 9: Testing the Coiled Tubing Jar 12

Section 10: Fluid Bleeding Instructions for Coiled Tubing Jars

- Coiled Tubing Jar Fluid Bleeding Prior to Field Use 13

Section 11: Coiled Tubing Jar Specifications 14

Section 12: Coiled Tubing Jar Replacement Parts

- and Numbered Illustration 15–16

Section 13: Coiled Tubing Jar Service Kit 17

The information contained in this document is subject to change without notice.

NATIONAL OILWELL VARCO, DOWNHOLE TOOLS PRODUCTS GROUP SHALL NOT BE LIABLE FOR TECHNICAL OR EDITORIAL ERRORS OR OMISSIONS CONTAINED HEREIN, NOR FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES RESULTING FROM THE FURNISHING, PERFORMANCE, OR USE OF THIS MATERIAL.

This document contains proprietary information, which is protected by copyright. All rights are reserved. No part of this document may be photocopied, reproduced or translated to another language without the prior written consent of National Oilwell Varco, Downhole Tools Products Group.

Product names mentioned herein may be trademarks and/or registered trademarks of their respective companies. KOPR-KOTE® is a registered trademark of Jet Lube, Incorporated.

© 2003 National Oilwell Varco, Downhole Tools Products Group. All rights reserved.

Third Edition, June 2003

Introduction

This instruction manual provides for the installation and maintenance of the Bowen Hydraulic Up/Down Coiled Tubing Jar. The information contained within is a guide and in no way covers all possible conditions, which may exist in a field condition.

How this Manual is Organized

This describes the contents of the manual.

Section 1: General Description

Provides a general description of the Bowen Hydraulic Up/Down Coiled Tubing Jar.

Section 2: Application

Provides the operator with the basic understanding of the general uses of the Coiled Tubing Jar.

Section 3: Operation

Gives the general guidelines and procedures for operating the Coiled Tubing Jar.

Section 4: Maintenance

This section provides the operator information and instruction required to properly maintain the Coiled Tubing Jar.

Section 5: Disassembly

The proper sequence for the disassembly of the Coiled Tubing Jar is covered in this section.

Section 6: Inspection

The operator is introduced to general information for inspecting and repairing the Coiled Tubing Jar parts.

Section 7: Assembly

This assembly section instructs the operator in the special points of assembly and parts sequence to assemble the Coiled Tubing Jar.

Section 8: Filling the Coiled Tubing Jar

In this section the operator will be guided through the instructions for filling the Jar with Bowen Coiled Tubing Jar Oil.

Section 9: Testing the Coiled Tubing Jar

Provides the testing instructions and performance requirements of the Coiled Tubing Jar.

Section 10: Fluid Bleeding Instructions for Coiled Tubing Jars

This section provides the specific instruction required to adjust the level of Coiled Tubing Jar Oil in the Jar.

Section 11: Coiled Tubing Jar Specifications

Numerous performance specifications and tightening torque are provided in the tables in this section.

Section 12: Coiled Tubing Jar Replacement Parts and Numbered Illustration

Provides diagrams of each Coiled Tubing Jar and the associated replacement part numbers.

Section 13: Coiled Tubing Jar Service Kit

Provides a diagram and list of the contents contained in the Service Kit.

Conventions and Measurements

The following words mark special messages throughout this manual and alert the operator to specific information of WARNING, CAUTION, and NOTE, as described below:

WARNING: The text set off in this manner indicates failure to follow directions in the WARNING can result in bodily harm or loss of life.

CAUTION: The text set off in this manner indicates failure to follow directions in this CAUTION can result in damage to equipment.

NOTE: The text set off in this manner presents clarifying information or specific instructions to the items immediately following the NOTE.

The following information is provided to convert the units of measurement referred to in this document, to your specific standards:

Pounds x .4536 = Kilograms

Pounds/Square Inches (psi) x .006894757 = Megapascal or Newton/Millimeter²

Foot-Pounds x 1.355818 = Newton-Meter

(Fahrenheit – 32) x 5/9 = Celsius

Inches x 25.40 = Millimeters

Foot-Pounds x 1.355818 = Joule

This Instruction Manual includes information pertaining to the Bowen Hydraulic Up/Down Coiled Tubing Jar, OD sizes: 1 11/16", 1 13/16", 2 1/8", 2 1/4", 2 7/8" and 3 1/8".

Section 1: General Description and Construction

The **Bowen Hydraulic Coiled Tubing Jar** (Figure 1.1) is a straight pull up and push down Jarring tool that employs a patented combination of proven principles of hydraulics and mechanics. It is designed to be operated in conjunction with the Bowen Coiled Tubing Jar Intensifier. This Jar is simple to assemble and its unique design allows for easy, dependable operation. No setting or adjustment is required before going in the hole, or after the fish is engaged. The Coiled Tubing Jar allows the operator to easily and simply control the intensity of Jarring blows by varying the applied load. The Jar can deliver a wide range of blows, from low to very high impact and impulse forces.

The variable impact control of the Coiled Tubing Jar is made possible by the metering action of the Cone assembly. Fluid flows from one side of the Cone to the other through a metering port as load is applied to the Jar. Forced through this restricted passage, flow is retarded in a manner that delays the stroke. This gives the operator ample time to take the necessary stretch in the running string (and Bowen Coiled Tubing Jar Intensifier) or apply slack off weight to strike a blow of given impact.

The Coiled Tubing Jar is capable of applying up only, down only, or up and down blows in succession. A series of up or down blows can be applied without having to apply the reverse Jarring cycle.

Another advantage of the Coiled Tubing Jar is the ease of closing or resetting. During closing or resetting, large ports

open in the Cone assembly, allowing unimpeded fluid flow. Since the metering action does not occur during closing, only sufficient weight to overcome friction is required to close the Jar.

The Jar's internal chambers are sealed at both ends. Therefore, the lubricating and operating fluids cannot escape and well fluids cannot enter these chambers. The lubricating and operating fluids constantly lubricate the internal working parts, promoting long wear life of the Jar. The comparatively large ID (Inside Diameter) of the Coiled Tubing Jar permits the use of drop balls for unlatching devices.

Section 2: Application

Prior to running any operation using the Coiled Tubing Jar, it is necessary to properly configure the appropriate mass above and below the Coiled Tubing Jar Intensifier, to achieve the desired inertia impact. It is therefore recommended running the Bowen Fishing Jar Placement Program.

Important Information

The Bowen Fishing Jar Placement Program is available to National Oilwell customers. The program should be run and used as a guide to optimize the string configuration; to include, if an intensifier should be used. The program provides information on impact forces and impulse values based on the fishing string components, the fish, the applied Pull Loads at the Jar, and other down-hole information. This maximizes the likelihood of success in all Jarring operations. The program also provides information to avoid excessively high impact loads. Load and impact force information can be compared to the strength of the fishing string (including all tools being used), and to the fish for possible limitations on Pull Loads and impact forces.

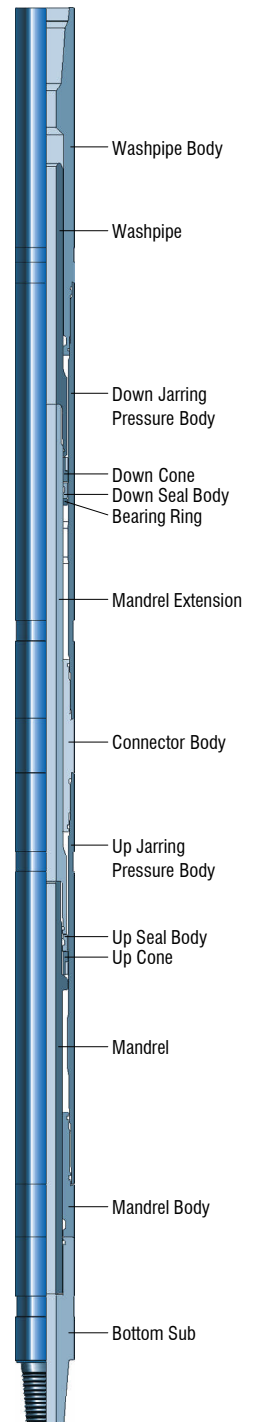


Figure 1.1
Hydraulic Coiled Tubing Jar

CAUTION: The Bowen Fishing Jar Placement Program is written specifically for Bowen Jars and Intensifiers with the unique characteristics of each tool incorporated in the program. See program for additional information or contact National Oilwell for a copy of the computer program.

General Guidelines for Coiled Tubing Fishing

Run the Coiled Tubing Jar, Weight Bar(s) and Coiled Tubing Jar Intensifier as close to the fishing tool as possible. The Weight Bar is usually 2 to 5 feet long. The lubricator must be of sufficient length to contain both the downhole fishing assembly and the fish.

NOTE: If the Coiled Tubing Jar Intensifier and/or Weight Bar(s) are not run with the Coiled Tubing Jar, due to a desire to keep the bottomhole assembly short, the effectiveness of the Jar will not be fully utilized.

Section 3: Operation

Preparation

Before using the Bowen Coiled Tubing Jar, carefully examine it to ensure the tool has been assembled and filled correctly and no leaks are evident.

NOTE: Bowen Coiled Tubing Jars give the best performance when using the Bowen formulated Coiled Tubing Jar Oil. This specially formulated Coiled Tubing Jar Oil is not the same as Bowen Jar Oil.

Insure the Coiled Tubing Jar is filled to the proper level with Bowen Coiled Tubing Jar Oil, and has been tested in a Bowen Coiled Tubing Jar and Coiled Tubing Jar Intensifier Tester or equivalent tester.

NOTE: Drift all the elements of the downhole fishing assembly with any drop balls which will be used.

The internal and external connections come from the Bowen manufacturing facilities with the proper torque. All external connections should be checked after use to ensure they are made up to the correct Tightening Torque Specification. Refer to Table 11.2.

CAUTION: Do not tong over the threaded connections. To do so will damage the Coiled Tubing Jar. Place the tongs approximately 4 inches from the thread shoulder.

Rig Up

WARNING: The Coiled Tubing Jar is in the closed position when it is shipped to the rig from the factory. Once closed, the Jar should not be left suspended, especially with any appreciable weight suspended below it. From this position, the Jar may open, dropping the length of its stroke, and may cause damage or injury.

For the maximum effectiveness of jar action, the Coiled Tubing Jar should be carefully installed in the string below the Weight Bar(s). The Bowen Coiled Tubing Jar Intensifier should be run above the Weight Bar(s).

Running Procedure Guidelines

After catching the fish, pull slowly to trip the Jar, but not to apply a substantial jar blow. Then pick up to see if the fish is free or can be freed with tension. If not, start Jarring with minimal Pull Load. Increase the load after a few cycles and continue the Jarring operation. Increase the load and continue the cycles, as required.

The Coiled Tubing Jar is capable of applying up only, down only, or up and down blows in succession. A series of up or down blows can be applied without having to apply the reverse Jarring cycle.

NOTE: The cycle life of the coiled tubing string should be considered when planning the Jarring load sequence.

Up Jar Operation

Pull the desired load. The Jar will trip in 1 to 2 minutes (at test load values). After tripping, slowly lower the tubing. It requires only minimal force to re-cock the Up Jar. When the Jar starts to take weight, the next Pull Load is ready to be applied. Repeat the Up Jar sequence as described above until the fish is freed.

NOTE: The cycle times will decrease somewhat after the first few cycles. This is due to the Jar warming up and decreasing the viscosity of the Coiled Tubing Jar Oil.

Down Jar Operation

Slack off the desired load. The Jar will trip in 1 to 2 minutes (at test load values). After tripping, slowly pull the tubing up. It requires only minimal force to re-cock the Down Jar. When the Jar starts to take weight, the next slack off load is ready to be applied. Repeat the Down Jar sequence as many times as required.

Troubleshooting

Operation difficulties are sometimes encountered by operators and some of these are listed below, along with corrective procedures.

- A. If unable to strike the initial up blow:
 1. Make sure the Jar is fully closed.
 - a. Lower the string further to apply more closing force before applying Pull Load.
 - b. If the pumps are running, the pump pressure will be exerting an opening force on the Jar. If enough additional weight cannot be applied to the Jar, to fully close it during the Jar's closing cycle, it may be necessary to temporarily reduce the pump pressure to allow the Jar to fully close.
 2. Pull up to the desired stretch in the string and set the brake. Hold this position until the Jar strikes a blow.

3. If still unable to strike the initial blow, increase tension in the running string, but do not exceed the previously determined safe load nor the maximum overpull (lb) for the Jar. Refer to Coiled Tubing Jar Specifications in Table 11.1.
- B. If unable to hit subsequent blows:
1. The corrective procedure is the same as listed under A., above.
- C. If blows are not as high as desired:
1. Insure the Jar is fully closed before applying pull. See A., above.
 2. Pull the running string up faster, but do not exceed the previously determined safe loads nor the maximum overpull (lb) for the Coiled Tubing Jar.
 3. Run the Bowen Fishing Jar Placement Program and vary the fishing string or fish configuration to obtain better results, (e.g. use a longer Weight Bar).

Rig Down

The Coiled Tubing Jar itself requires no special action for Rig Down. It is recommended the Jar not remain suspended in the elevator for extended periods of time. After performing rig floor inspection for oil leaks, lay it on the derrick floor.

WARNING: The Coiled Tubing Jar is in the cocked (closed) position when it is shipped to the rig from the factory. Once closed, the Jar should not be left suspended, especially with any appreciable weight suspended below it. From this position, the Jar may open, dropping the length of its stroke, and may cause damage or injury.

Section 4: Maintenance

This section contains information procedures the operator must be familiar with to successfully maintain the Bowen Coiled Tubing Jar. Maintenance of the Bowen Coiled Tubing Jar is minimal, but important. The primary maintenance is normally confined to complete inspection and redressing after each prolonged or hard use, and careful checking after every moderate use. Magnetic particle inspection of stressed components should be performed after each use.

Rig Floor Maintenance

After moderate use on a short job, the Coiled Tubing Jar can be kept at the rig site and requires only minor maintenance. In most cases this may be done on the rig floor.

Immediately after removing the Jar from the fishing string, flush all mud from the bore, especially inside the Washpipe. To prevent corrosion and facilitate tool make-up during the next tool use, coat the Coiled Tubing Jar joint box and pin threads with KOPR-KOTE anti-gall grease.

Dressing Area Maintenance

After use, the Bowen Coiled Tubing Jar should be taken to an adequate dressing area to be completely disassembled, cleaned, inspected and repaired, as required, and then reassembled.

Equipment

The following list of tools, equipment and parts should be obtained before starting:

- Bench Vise or Bowen Vise and Tong (suitable for the Jar size)
- Overhead Crane (2,000 lb minimum capacity)
- Pipe Wrenches (suitable for the OD's of interior and exterior Jar parts)
- Open-end Wrenches (suitable for wrench flats on the interior Jar parts)

- Nylon Strap (suitable for lifting and handling parts with the overhead crane without damaging the parts)
- Bowen Jar Tester
- Seal Setting Tools (41, 42) Refer to Table 12.1.
- Bowen Coiled Tubing Jar Oil
- Rubber Mallet
- Compete O-ring Packing Set
- KOPR-KOTE (for lubricating all the threads – Part No. 153823)
- Service Kit (see Figure 13.1).

Section 5: Disassembly

Included in this section are the steps for the operator to successfully complete the disassembly of the Coiled Tubing Jar.

Disassembly Notes

1. The item numbers in parenthesis, in the following descriptions, will correspond to item numbers of parts in Figure 12.1.
2. Bowen recommends an assembly drawing be used when disassembling the tool. Assembly drawings, per part number, are available through Bowen.
3. To prevent damaging parts during servicing, **DO NOT** use the vise or wrenches over the Fill Plug (7) holes, on any of the seal surfaces, or any of the other smooth surfaces. Wrench areas are marked on the internal parts.
4. When disassembling the Coiled Tubing Jar, note the direction and location of all O-rings, and back-up rings. This will help in the reassembly of the Jar later.
5. All threads are right-handed.

Complete Disassembly

Before reading this section, read Dressing Area Maintenance.

For complete disassembly of the Bowen Coiled Tubing Jar, proceed as follows:

WARNING: DO NOT remove the Fill Plugs until the tool is fully disassembled. The possibility of trapped residual high pressure exists and can cause possible injury to personnel or damage to the tool.

1. Place the Bowen Coiled Tubing Jar in the Jar Tester and pull it to the full open position. This will aid in the disassembly. When the Jar is in this position, approximately 9 to 12 inches of the Mandrel (9) seal surface is exposed.
2. Clamp the Down Jarring Pressure Body (34) securely in the vise.
3. Break the connection between the Washpipe Body (35) and the Down Jarring Pressure Body (34). Place a pan under this connection to catch the hydraulic oil.
4. Slowly start to unscrew the Washpipe Body.

WARNING: DO NOT stand at either end of the tool until the Washpipe Body is removed.

5. When you have unscrewed it $\frac{3}{4}$ inch, **STOP!** Allow any trapped pressure to escape before continuing to unscrew the Washpipe Body. Slowly unscrew the Washpipe Body and let the oil drain into the pans. **DO NOT** reuse this oil.
6. Reposition the Jar in the vise and clamp on the Connector Body (20). Break the connection between the Connector Body and the Down Jarring Pressure Body. Unscrew the Down Jarring Pressure Body and drain any additional oil into the pans.

7. Using an open-end wrench, break the connection between the Washpipe (32) and the Mandrel Extension (17) and unscrew the Washpipe.

8. Remove the Spacer (31), size $1\frac{11}{16}$ inch only, and Down Cone (26). This should slide off easily by hand.

9. Remove the Down Seal Body (27) using a rubber mallet or a piece of wood. Keep these components (Down Cone and Down Seal Body) together as a set. These are the Down Jarring Section components. When the Jar is reassembled, this set should be used only on the Mandrel Extension.

10. Sizes $1\frac{11}{16}$ inch, $2\frac{1}{8}$ inch, and $2\frac{1}{4}$ inch only: Remove the Split Ring (24) and Split Ring Retainer (25).

11. Sizes $2\frac{7}{8}$ inch and $3\frac{1}{8}$ inch only: Remove the Bearing Ring (23).

12. Reposition the Jar in the vise and clamp on the Up Jarring Pressure Body (19). Break the connection between the Connector Body and the Up Jarring Pressure Body. Unscrew the Connector Body.

NOTE: The internal parts and the Bottom Sub (10) will turn with the Connector Body.

13. Remove the Connector Body and drain any additional oil from the Up Jarring Pressure Body into the pans.

14. Reposition the Jar in the vise and clamp on the Mandrel Body (1). Break the connection between the Mandrel Body and the Up Jarring Pressure Body. Unscrew the Up Jarring Pressure Body.

15. Break the connection between the Mandrel Extension (17) and the Mandrel (9). Use a pipe wrench on the "WRENCH AREA" of the Mandrel and an open-end wrench on the Mandrel Extension. Unscrew the Mandrel Extension.

16. Remove the Up Seal Body (13) using a rubber mallet or a piece of wood.

NOTE: It is usually difficult to get the Upper Seal Body off. DO NOT pry the seal body off with a screw driver or any thing else which can damage the spiral groove sealing face.

17. Remove the Up Cone (12). This should slide off easily by hand. Keep these components (Up Cone and Up Seal Body) together as a set. These are the Up Jarring Section components. When the Jar is reassembled, this set should be used only on the Mandrel.

18. Reposition the Jar in the vise and clamp on the Bottom Sub (10). Break the connection between the Bottom Sub and the Mandrel (9) using a pipe wrench on the "WRENCH AREA." Unscrew the Mandrel.

19. Place the Mandrel Body (1) in the vise and pull the Mandrel out of it.

20. Remove both Fill Plugs (7) from the Mandrel Body.

21. Remove all O-rings and back-up rings from all parts using a No. 625 or No. 626 tool from the Coiled Tubing Jar Service Kit (see Figure 13.1), or a screwdriver with its tip bent at an 80 to 90 degree angle. Be careful not to damage the seal grooves or other surfaces of the parts.

22. Immediately after disassembling the Jar, thoroughly inspect all the metal parts.

Section 6: Inspection

Included in this section are the steps for the operator to successfully complete the inspection of the Coiled Tubing Jar.

Inspection Notes

- Refer to Figure 12.1 for the location of parts during inspection. The item numbers in parenthesis, in the following descriptions, will correspond to item numbers in Figure 12.1.
- Bowen recommends an assembly drawing be used when inspecting the tool. Assembly drawings, per part number, are available through Bowen.
- The types of damage to inspect for are: pits, nicks, scratches, burrs, cracks, galled areas, worn areas, etc.
- Minor damage may be removed by polishing with "fine" emery cloth.
- Parts with major damage must be replaced or undergo a more extensive repair process.
- Any abrasion on O-ring grooves or seal surfaces can damage the seals and result in a loss of fluid or pressure control during the operation of the tool.
- Any damaged areas left unrepaired can cause additional damage to the part and possibly other parts. This could result in the part(s) being unrepairable and/or in the Jar failing to work.

Inspection and Repair Procedures

1. Carefully clean all parts with solvent and wipe them dry with a clean, lint free cloth.
2. Inspect all box and pin thread sections of all parts.
 - a) Check the threads on all parts for damage. Minor damage may be removed with a triangular hand file before polishing with "fine" emery cloth.

- b) Examine the seal surfaces, smooth surfaces and corners, sides and bottom of all O-ring grooves. If damage is found, take the appropriate action described in the notes above.
- c) If the Jar has been heavily abused (pulled harder than the maximum allowable or excessively bent in a crooked hole), fatigue cracking may occur. If fatigue cracking occurs, it is most likely to be in the corners where the cross-sectional area changes. Therefore, examine the corners at the bottom of the O-ring grooves and corners at the bottom of the thread relief. Also, examine the threads (particularly the first 6 to 8 threads nearest the thread relief). Parts with cracks must be replaced.

WARNING: Magnetic particle inspection is strongly recommended for locating fatigue cracks. Parts with cracks must be replaced.

3. Examine the Down Jarring Pressure Body (34) and Up Jarring Pressure Body (19) bores, where the Cones (12 and 26) seal. These are the reduced ID areas near the middle of the bodies. Minor damage should be smoothed out with a "very fine" emery cloth. Damage which cannot be smoothed out will render it unfit for further service unless the bores are reworked.
4. Carefully examine the Cones (12 and 26) and Seal Bodies (13 and 27). Polish off any damage with a "very fine" emery cloth. Be very careful when working on these parts, because the critical surfaces are ground and polished. Also, the mating surface between the Cone

and Seal Body must remain flat and smooth. Damage which cannot be smoothed out will render these parts unusable. The Cone OD should interfere slightly with the reduced ID in the Pressure Bodies. If the Cone OD does not interfere, or if there is minor damage on the Cone or Seal Body which cannot be polished out, then replace these parts.

5. Sizes 3 1/8 and 2 7/8 only: Examine the Bearing Ring (23). If it is bent or deformed, replace it. Remove any upset material with a hand grinder or a file, followed by polishing the area with a "fine" emery cloth.
6. Examine the Mandrel Body (1). Inspect the seal bores and threads in both Fill Plug holes.
7. Examine the seal surfaces, seal grooves, and metal-to-metal sliding surfaces of the Mandrel Body (1), Mandrel (9), Connector Body (20), and Washpipe (32). If damage is found, take the appropriate action as described in the notes above.
8. Inspect the knocker surface on the Mandrel (9) and the corresponding impact surface on the end of the Mandrel Body (1) for upset metal. Remove any upset material with a hand grinder or a file, followed by polishing the area with a "fine" emery cloth.
9. This area of the Mandrel should also be examined by magnetic particle methods for small cracks. If cracks are found, this part should be replaced.
10. Inspect the splines on the Mandrel Extension (17) and the Connector Body (20). Any damage found is to be removed. A hand grinder or a file may be used followed by polishing the area with a "fine" emery cloth.

11. The Mandrel (9) and Mandrel Extension (17) should be inspected for "necking" in the Cone area. This type of damage is always the result of excessive pull or Pull Loads creating high internal pressure which tends to collapse the parts at this point. A straight edge of some form may be necessary to detect such damage.
12. Inspect the Fill Plugs (7). If they are damaged, replace them.
13. Clean all the parts following repair and polishing, making sure that no steel filings, rust, grease or dirt remain on the parts.
14. If the Jar is not to be assembled soon after these inspections, coat each part with a light coat of oil. Place the parts on clean, lint-free cloths.

Section 7: Assembly

Included in this section are the steps for the operator to successfully complete the assembly of the Coiled Tubing Jar.

Assembly Notes

- Bowen recommends an assembly drawing be used when assembling the tool. Assembly drawings, per part number, are available through Bowen.
- The Coiled Tubing Jar Replacement Parts list (Table 12.1) contains all components in the order in which they are assembled, with sub-assembly parts listed below each major component. An item number is assigned for each part name. Each item number and part name in Table 12.1 corresponds to the part illustration in Figure 12.1.
- Part numbers are specific to Jar OD sizes as indicated in the parts listing.

CAUTION: The Bowen Coiled Tubing Jar is a hydraulic Jar; therefore, close tolerances and smooth finishes are mandatory. Also, the Jar must be kept free of contamination (dirt, sand, metal, etc.). Care must be taken to insure that no KOPR-KOTE ends up in the Jar Oil wetted areas of the Jar. Contamination left on the parts can damage them or the seals and could result in malfunction of the Jar.

- To prevent damage during servicing, do not use vise, tongs, wrenches or chains over the Fill Plugs (7), on any seal surfaces, or on any other smooth surface of the tool.
- All connections are made with right-handed threads and should be coated with KOPR-KOTE, taking care not to lubricate above the thread relief. Remove excess KOPR-KOTE from the threads. Due to the weight of some of the Jar components, it may be necessary to assemble the unit with a 2,000 lb. capacity overhead hoist.
- Before assembly, make sure all parts are clean and in good condition. Installing marginal components will cause time loss and cost more than replacing the worn components.
- All metal parts should be thoroughly steam cleaned or washed with a good grade solvent. The parts should be blown dry with shop air or wiped with clean, soft, lint-free cloths. The parts should then be thoroughly oiled with clean Coiled Tubing Jar Oil.
- Use clean Coiled Tubing Jar Oil (45) to lubricate all internal parts during the assembly.
- It is recommended that the Jar be redressed with a new complete O-ring Packing Set (44), which consists of all O-rings for the specific Jar.

- Replace any Non-Extrusion and Seal Protector Rings that are not in good condition.

CAUTION: The Bowen Coiled Tubing Jar is a hydraulic Jar; therefore, close tolerances and smooth finishes are mandatory. The Jar must be kept free of contamination (dirt, sand, metal shavings, etc.). Care must be taken to insure that no KOPR-KOTE ends up in the Jar Oil wetted areas of the Jar. Contamination left on the parts can damage them or the seals and could result in malfunction of the Jar.

- Use a pipe wrench to tighten the external parts. The internal parts should be tightened according to the noted procedure.
- Refer to Table 11.2, for the recommended torque that should be applied to the corresponding threaded connection in the Jar.
- Wrench areas are marked on the internal parts.

Pre-Assembly

Prior to Main Assembly, Non-Extrusion Rings, Seal Protector Rings, and O-rings should be installed in the Mandrel Body (1), Washpipe Body (35), Up Seal Body (13) and Down Seal Body (27).

NOTE: The Seal Bodies require only one Non-Extrusion Ring and one Seal Protector Ring each.

Coat all Non-Extrusion Rings, Seal Protector Rings, and O-rings with clean Jar Oil and install them in their proper grooves as detailed below:

1. One Non-Extrusion Ring is installed first, with its beveled surface conforming to the beveled surface of the groove.
2. Seal Protector Ring(s) are installed next. These are deformed slightly to permit entry into the body, then straightened and flattened by use of Tool No. 626 from the Coiled Tubing Jar Service Kit.

3. Install the other Non-Extrusion Ring as explained above.
4. Install the O-ring.
5. The complete assembly is then set with the proper Setting Tool.

Mandrel, (9), Mandrel Body (1), and Fill Plug (7)

1. Install the Non-Extrusion Ring (2), Seal Protector Ring(s) (3), other Non-Extrusion Ring, and O-ring (4) into the ID of the stencil groove end of the Mandrel Body. Refer to Figure 7.1.

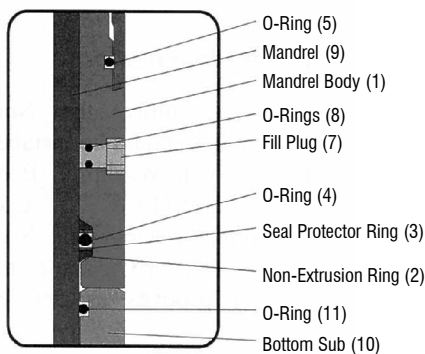


Figure 7.1
Mandrel, Mandrel Body, and Fill Plug

2. Install O-rings (5 and 11) on the OD of the non-stencil groove side of the Mandrel Body.
3. Use the O-ring Installation Tool for Fill Plug, No. 147647, from the Coiled Tubing Jar Service Kit (see Figure 13.1), to install the O-rings (8) on the Fill Plug (7). A few drops of oil on this assembly tool will aid in the installation.

Washpipe (32) and Washpipe Body (35)

1. Install a Non-Extrusion Ring (37), Seal Protector Ring (38), other Non-Extrusion Ring, and O-ring (36) onto the ID of the Washpipe Body. Refer to Figure 7.2.

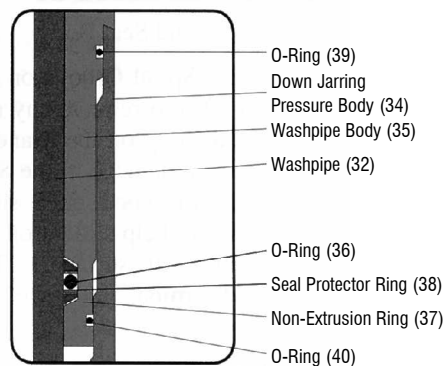


Figure 7.2
Washpipe and Washpipe Body

2. Install O-rings (39 and 40) on the OD of the of the Washpipe Body.

Up Cone (12) and Up Seal Body (13)

1. Install Non-Extrusion Ring (14), Seal Protector Ring (15), and O-ring (16) onto the ID of the Up Seal Body. Refer to Figure 7.3.

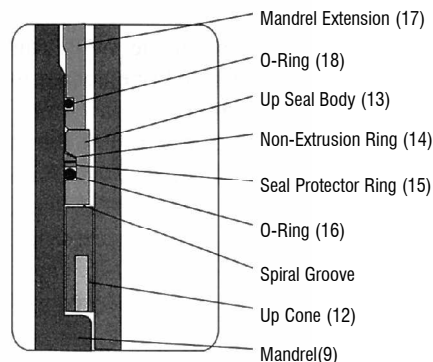


Figure 7.3
Up Cone and Up Seal Body

2. Install O-ring (18) onto the ID of the Mandrel Extension (17).

Down Cone (26) and Down Seal Body (27)

1. Install Non-Extrusion Ring (28), Seal Protector Ring (29), and O-ring (30) onto the ID of the Down Seal Body. Refer to Figure 7.4.

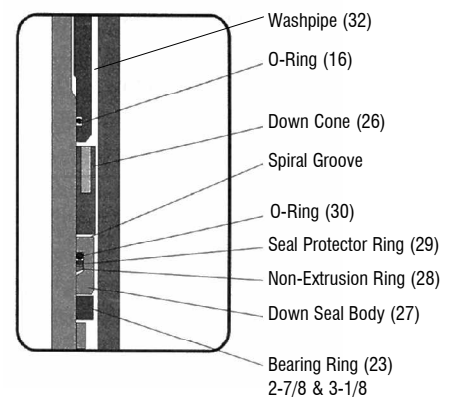


Figure 7.4
Down Cone and Down Seal Body

2. Install O-ring (16) onto the ID of the Washpipe (32).

Main Assembly

1. Clamp the Mandrel Body (1) securely in the vise. Refer to Figure 7.1.

CAUTION: Do not clamp on the Fill Plug holes.

2. Coat the polished surface of the Mandrel (9) with clean Jar Oil and insert it into the Mandrel Body. Slide it until the knocker touches the end of the Mandrel Body.
3. Apply KOPR-KOTE to the Bottom Sub (10) internal threads and install on the Mandrel.
4. Reposition the Jar in the vise and clamp on the Bottom Sub (10). Tighten the Mandrel to the Bottom Sub to the appropriate value (see Table 11.2), using a pipe wrench on the indicated "WRENCH AREA." Remove any wrench marks with a file. Remove any metal filings.

5. Apply some clean Jar Oil to the short seal surface of the Mandrel and install the Up Cone (12). This Cone should be the same one which was removed from the Mandrel during disassembly. This part should slide easily and without any indication of binding.

CAUTION: The Up Cone should be assembled as shown in Figure 7.3. The Cone will not function properly if it is installed incorrectly on the Mandrel.

6. Run a needle in the Spiral Groove on the Up Seal Body (13) to remove any dirt, and install the Seal Body on the Mandrel until it contacts the Cone. To prevent damage to the Up Seal Body, use a rubber mallet, a piece of wood, or a short length of PVC pipe to help slide it on the Mandrel seal surface. The spiral groove side should face the Cone.
7. Apply KOPR-KOTE to the female threads of the Mandrel Extension (17). Remove any KOPR-KOTE which is on or near the side of the O-ring. Install the Mandrel Extension onto the Mandrel and tighten, using an open-end wrench to the appropriate value. Refer to Table 11.2.
8. Reposition the Jar in the vise. Clamp securely on the Mandrel Body, as before.
9. Apply KOPR-KOTE to the threads on the Mandrel Body and Jar Oil to the O-rings.
10. Apply clean Jar Oil to the Cone and Seal Body area. Also apply clean Jar Oil to the splines on the Mandrel Extension.
11. Install the Up Jarring Pressure Body (19) to the Mandrel Body and tighten to the appropriate value. Refer to Table 11.2.

CAUTION: The Up Jarring Pressure Body is not reversible! The Connector Body end is marked on the outside of the Up Jarring Pressure Body. The end which is not marked is installed on the Mandrel Body.

12. Apply KOPR-KOTE to the threads on the Connector Body (20) and Jar Oil to the O-rings. Install the Connector Body on the Up Jarring Pressure Body and tighten to the appropriate value (see Figure 11.2). The Connector Body is reversible.

NOTE: The Mandrel (9), Mandrel Extension (17) and Bottom Sub (10) will turn with the Connector Body.

13. Sizes 1¹¹/₁₆ inch, 2¹/₈ inch, and 2¹/₄ inch only: Install the Split Ring (24) and Split Ring Retainer (25) on the Mandrel Extension.
14. Sizes 2⁷/₈ inch and 3¹/₈ inch only: Install the Bearing Ring (23) on the Mandrel Extension. Refer to Figure 7.4.
15. Apply clean Jar Oil to the short seal surface on the Mandrel Extension (17).
16. Run a needle in the Spiral Groove on the Down Seal Body (27) to remove any dirt, and install the Seal Body on the Mandrel Extension. To prevent damage to the Seal Body, use a piece of wood or a short length of PVC pipe to help slide it on the Mandrel Extension seal surface. The spiral groove side must not face the splines.
17. Install the Down Cone (26) on the Mandrel Extension. This should be the same one which was removed from the Mandrel Extension during disassembly. This part should slide easily and without any indication of binding.

CAUTION: The Down Cone should be assembled as shown in Figure 7.4. The Cone will not function properly if it is installed incorrectly on the Mandrel Extension.

18. Size 1¹¹/₁₆ inch only: Install the Spacer (31) on the Mandrel Extension. Refer to Figure 12.1.
19. Apply KOPR-KOTE to the Washpipe (32) threads. Remove any KOPR-KOTE which is on or near the side of the O-ring. Install the Washpipe onto the Mandrel Extension and use an open-end wrench to tighten to the appropriate value. Refer to Table 11.2.
20. Apply clean Jar Oil to the Cone and Seal Body area and the polished surface on the Washpipe.
21. Apply KOPR-KOTE to the threads on the Connector Body (20) and Jar Oil to the O-rings. Install the Down Jarring Pressure Body (34) to the Connector Body and tighten to the appropriate value. Refer to Table 11.2.
- CAUTION:** The Down Jarring Pressure Body is not reversible! The Connector Body end is marked on the outside of the Up Jarring Pressure Body. The end which is marked is installed on the Connector Body.
22. Apply KOPR-KOTE to the threads on the Washpipe Body (35) and Jar Oil to the O-rings. Install the Washpipe Body onto the Down Pressure Body and tighten to the appropriate value. Refer to Table 11.2.

Section 8: Filling the Coiled Tubing Jar

To fill the Jar, complete the following procedure:

1. Stand the Jar straight up with the Bottom Sub on top. There should be approximately 6 to 9 inches of the Mandrel seal surface exposed. This indicates that the Jar is in the Up position. It is easier to completely fill the Jar when it is in this position.
2. Attach the Exhaust Hose Assembly (Part No. 33435) to one of the Mandrel Body Fill Plug holes and the Volume Pump Hose (Part No. 2581) to the other hole (see Figure 13.1). There should be a filter on the Volume Pump Hose side of the Pump and the Exhaust Hose should return oil to the Volume Pump reservoir.

CAUTION: Use only Bowen Coiled Tubing Jar Oil (Part No. 154549) or an approved substitute in the Bowen Coiled Tubing Jar.

3. Pump Coiled Tubing Jar Oil into the tool at a moderate speed, to allow uniform smooth flow.
4. As the tool fills, oil and air will begin to flow out the Exhaust Hose. Continue to pump until all air bubbles cease to appear in the out flowing oil.
5. Allow the Jar to sit without pumping for a few minutes. Then start to pump until air bubbles again cease to appear in the out flowing oil. Repeat this step as often as necessary to insure only a minimal amount of air is left in the Jar.

6. When the air bubbles cease, immediately detach the Exhaust Hose and insert the Fill Plug (7) into the Mandrel Body. Tighten this Fill Plug securely.
7. Next, remove the Volume Pump Hose and insert the other Fill Plug (7) into the Mandrel Body. Tighten this Fill Plug securely. The Jar is now ready to be tested.

Section 9: Testing the Coiled Tubing Jar

After the Jar has been completely assembled and filled, it should be tested in a Bowen Coiled tubing Jar and Coiled Tubing Jar Intensifier Tester (see Figure 9.1) or other suitable test rack which has a readout for the applied push and pull loads.

NOTE: The Bowen Coiled Tubing Jar will not test the same in a Jar tester that is not able to pull as fast as a standard Bowen Jar Tester operating at 60Hz power. The tester speed should be 2.5 ft/sec.

WARNING: The Bowen Coiled Tubing Jar will generate extremely high internal pressures during testing! Follow proper safety precautions while testing the Jar.

The Jar should be in the Up position with 6 to 9 inches of the Mandrel exposed.

It is recommended that the load and time of each test be recorded. The time should decrease with each subsequent test. This is due to the oil becoming slightly less viscous as it heats up during the repeated cycles.

To test the Jar, use the Pull and Push Loads (see Table 11.1) and use the following procedure:

1. Place the Jar in the Bowen Jar Tester and Open the Jar by applying Pull Load.
2. Set the Bowen Jar Tester to the charted testing Pull Load.
3. To do a Pull Test, push the Jar until it begins to pick up load. **STOP!**
4. Actuate the Jar in the Pull Stroke. It may be necessary to slightly adjust the load during the initial Pull Test. Observe the movement of the Jar during this time to assure that it is operating properly. Movement should be slow but steady without any jerks or stops. If the Jar does not operate as required, it is permissible to repeat the Pull Stroke.
5. To repeat the Pull Stroke, Push the Jar until it begins to pick up load. Repeat Step 4.

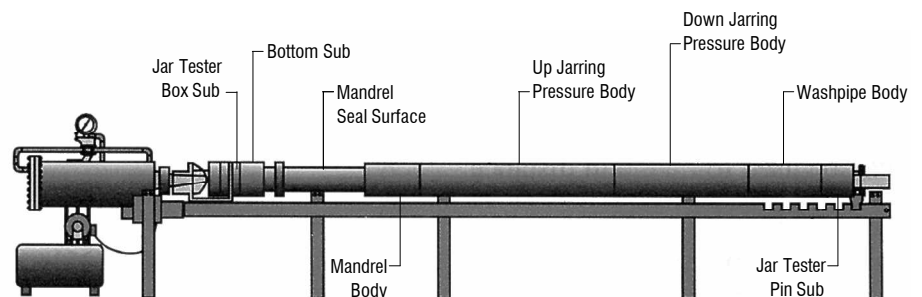


Figure 9.1
Testing the Coiled Tubing Jar Illustrated

6. Repeat the Pull Load Test (Steps 4 and 5) 5 to 10 times to assure uniform action. The Jar should take between 2 to 4 minutes to pull through its Jar stroke.
7. Set the Tester to the charted Push Test Load.
8. Actuate the Jar in the Push Stroke. It may be necessary to slightly adjust the load during the initial Push Test. Observe the movement of the Jar during this time to assure that it is operating properly. Movement should be slow but steady without any jerks or stops. If the Jar does not operate as required, it is permissible to repeat the Push Stroke.

WARNING: Extreme care should be taken to insure that the Pull Load is not applied during the Push Load Test! This may damage the Jar requiring replacement of parts.

9. To repeat the Push Stroke, Pull the Jar until it begins to pick up load. Repeat Step 8.
10. Repeat the Push Load Test (Steps 8 and 9), 5 to 10 times to assure uniform action. The Jar should take between 2 to 4 minutes to push through its jar stroke.
11. The Jar should be Pushed to its full closed position after the final Push Load Test.
12. Inspect the Jar for any leaks after the Pull and Push Load Tests, particularly around the Mandrel Seals and the Fill Plugs.

Section 10: Fluid Bleeding Instructions for Coiled Tubing Jars

Coiled Tubing Jar Fluid Bleeding Prior to Field Use

If the anticipated bottom hole temperature is greater than 180°F (82°C), then it is necessary to bleed a small amount of Coiled Tubing Jar Oil from the tool, following testing, and prior to running it in the well. This insures that the internal pressures will not damage the tool at operating temperatures and rated loads. Refer to Table 11.3.

CAUTION: Before bleeding any fluid from the Jar, it must have been completely filled and tested in the Coiled Tubing Jar Tester. If there is air in the tool at this time, the final amount of fluid in the tool, after the prescribed amount of oil is bled out, will be less than required for the Jar to operate properly.

1. Place the Jar in a vise or on a rack. Rotate the Jar until one Fill Plug (7) is straight up. Remove the plug and install the Fluid Bleed Valve Assembly (Part No. 155400). Insure all the valve component fittings are tight. Close the valve. Refer to Figure 10.1.

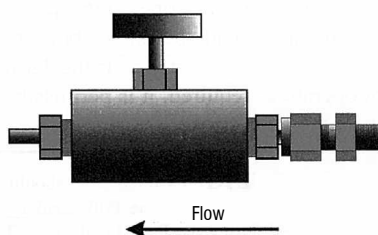


Figure 10.1
Fluid Bleed Valve Assembly

2. Rotate the Jar until the other Fill Plug is straight up.
3. Remove the Fill Plug.

4. Place the graduated cylinder below the valve to catch and measure the amount of oil that is bled out of the Jar.
5. Slowly open the valve allow the Coiled Tubing Jar Oil to drain into the cylinder.
6. When the specified amount of Coiled Tubing Jar Oil is in the cylinder, close the valve.

WARNING: DO NOT perform a Pull Test while the Fluid Bleed Valve is installed on the Coiled Tubing Jar. This action could result in serious injury to personnel.

7. Install the Fill Plug and tighten securely.
8. Rotate the Jar until the Fluid Bleed Valve is straight up.
9. Remove the Fluid Bleed Valve Kit and install the Fill Plug. Tighten the Fill Plug securely.

NOTE: Check the condition of the Fill Plug O-ring prior to installation. Replace the O-ring, if damaged.

Section 11: Coiled Tubing Jar Specifications

Table 11.1: Coiled Tubing Jar Specifications

OD Size (in)	1-11/16	1-13/16	2-1/8	2-1/4	2-7/8	3-1/8
ID Size (in)	9/16	9/16	3/4	3/4	1	1-1/4
Assembly Part Number	155876	153844	155235	155235	156231	155267
Standard Connection	1 AM M.T.	1 AM M.T.	1-1/4 API Reg	1-1/4 API Reg	2-3/8 AM-PAC	2-3/8 API Reg
Overall Length – Closed (in)	69	67	68	68	84	84
Total Stroke (in)	9	9	10	10	12	12
Approximate Weight (lb)	33	36	49	57	96	126
Max. Overpull (lb)	10,000	12,000	18,000	22,000	32,000	40,000
Max. Overpush (lb)	10,000	12,000	18,000	22,000	32,000	40,000
Max. Lift After Jarring (lb) *	50,000	69,000	95,000	95,000	195,000	233,000
Torsion Yield (ft-lb) *	330	150	700	700	2,700	3,000
Testing Pull Load (lb)	8,000	10,000	16,000	16,000	30,000	30,000
Testing Push Load (lb)	4,000	6,000	10,000	10,000	20,000	20,000
Pump Open Area (sq in)	0.69	0.78	1.22	1.22	2.4	3.13

NOTE: * Strengths listed are calculated theoretical yield points and are accurate within 20%.

Table 11.2: Tightening Torque Specifications

OD Size (in)	1-11/16	1-13/16	2-1/8	2-1/4	2-7/8	3-1/8
ID Size (in)	9/16	9/16	3/4	3/4	1	1-1/4
Bottom Sub to Mandrel	160	300	400	400	1400	1600
Mandrel Body to Upper Pressure Body	350	500	700	1100	1500	2100
Upper Pressure Body to Connector Body	350	500	700	1100	1500	2100
Connector Body to Lower Pressure Body	350	500	700	1100	1500	2100
Lower Pressure Body to Washpipe Body	350	500	700	1100	1500	2100
Mandrel to Mandrel Extension	160	75	300	300	1300	1300
Mandrel Extension to Washpipe	160	75	300	300	1300	1300

NOTE: Tightening Torque values are in ft-lb. The above make up torques are the maximum recommended make up torques for each connection. They are set at 50% of the calculated theoretical yield torque.

Table 11.3: Coiled Tubing Jar Fluid Bleed Volumes

OD Size (in)	1-11/16	1-13/16	2-1/8	2-1/4	2-7/8	3-1/8
ID Size (in)	9/16	9/16	3/4	3/4	1	1-1/4
Amount of Fluid to Bleed (ml) {oz}	6 – 8 {.20 – .27}	9 – 12 {.30 – .41}	4 – 9 {.14 – .30}	4 – 9 {.14 – .30}	22 – 32 {.74 – 1.08}	25 – 38 {.85 – 1.28}

Pounds x .4536 = Kilograms

Pounds/Square Inches (psi) x .006894757 = Megapascal or Newton/Millimeter²

Foot-Pounds x 1.355818 = Newton-Meter

(Fahrenheit – 32) x 5/9 = Celsius

Inches x 25.40 = Millimeters

Foot-Pounds x 1.355818 = Joule

Section 12: Coiled Tubing Jar Replacement Parts and Numbered Illustration

Table 12.1: Coiled Tubing Jar Replacement Parts

OD Size (inches)			1-11/16	1-13/16	2-1/8	2-1/4	2-7/8	3-1/8
ID Size (inches)			9/16	9/16	3/4	3/4	1	1-1/4
Assembly Part Number			155876	153844	155235††	155235††	156231	155267
Item No.	Part Description	No. Req.						
1	MANDREL BODY	1	155877/010	153856/010	155237/010	155237/011	156232/010	155269/010
2*	Non-Extrusion Ring	2	365/060	365/065	365/008	365/008	365/114	365/135
3*	Seal Protector Ring	2	375/065	375/070	375/090	375/090	375/120	375/135
4	O-ring	1	568213/020	568214/020	568218/020	568218/020	568327/020	568329/020
5	O-ring	1	568025/020	568219/020	568030/020	568030/020	568035/020	568036/020
6	O-ring	1	568028/020	568026/020	568031/020	568031/020	568143/020	568039/020
7*	Fill Plug	2	617T/005	617T/005	617T/005	617T/005	617T/005	617T/005
8	O-ring	2	568005/021	568005/021	568005/021	568005/021	568005/021	568005/021
9	MANDREL	1	155878/010	153846/010	155236/010	155236/010	156233/010	155268/010
10 †	BOTTOM SUB	1	155879	152809	155238††	155238††	156234	155270
11	O-ring	1	568021/020	568022/020	568026/020	568026/020	568132/020	568033/020
12*	UP CONE	1	155880/010	155418/010	155247/010	155247/010	156235/010	155279/010
13*	UP SEAL BODY	1	155881/010	155089/010	155249/010	155249/010	156236/010	155281/010
14*	Non-Extrusion Ring	1	155905/005	154080/005	154556/005	154556/005	156271/005	155308/005
15*	Seal Protector Ring	1	155904/005	154079/005	154555/005	154555/005	156270/005	155309/005
16	O-ring	1	568021/020	568118/020	568124/020	568124/020	568224/020	568225/020
17	MANDREL EXTENSION	1	155882/010	153848/010	155239/010	155239/010	156237/010	155271/010
18	O-ring	1	568021/020	568118/020	568026/020	568026/020	568132/020	568032/020
19*	UP JARRING PRESSURE BODY	1	155886/010	153845/010	155241/010	155241/011	156238/010	155273/010
20	CONNECTOR BODY	1	155887/010	153855/010	155242/010	155242/011	156239/010	155274/010
21	O-ring	2	568025/020	568027/020	568030/020	568030/020	568035/020	568036/020
22	O-ring	2	—	—	—	—	568143/020	568039/020
23	BEARING RING	1	—	—	—	—	156240/010	155272/010
24	SPLIT RING	1	155883/010	—	155504/010	155504/010	—	—
25	SPLIT RING RETAINER	1	155884/010	—	155503/010	155503/010	—	—
26*	DOWN CONE	1	155880/010	155418/010	155247/010	155247/010	156235/010	155279/010
27*	DOWN SEAL BODY	1	155881/010	155089/010	155249/010	155249/010	156236/010	155281/010
28*	Non-Extrusion Ring	1	155905/005	154080/005	154556/005	154556/005	156271/005	155308/005
29*	Seal Protector Ring	1	155904/005	154079/005	154555/005	154555/005	156270/005	155309/005
30	O-ring	1	568021/020	568118/020	568124/020	568124/020	568224/020	568225/020
31	Spacer	1	155885/010	—	—	—	—	—
32	WASHPIPE	1	155888/010	153850/010	155244/010	155244/010	156241/010	155276/010
33	O-ring	1	568021/020	568118/020	568026/020	568026/020	568132/020	568032/020
34*	DOWN JARRING PRESSURE BODY	1	155889/010	153847/010	155243/010	155243/011	156242/010	155275/010
35 †	WASHPIPE BODY	1	155890	153849	155245††	155245††	156243	155277
36	O-ring	1	568119/020	568214/020	568218/020	568218/020	568327/020	568329/020
37*	Non-Extrusion Ring	2	155907/005	365/065	365/008	365/008	365/114	365/135
38*	Seal Protector Ring	2	155906/005	375/070	375/090	375/090	375/120	375/135
39	O-ring	1	568025/020	568028/020	568030/020	568030/020	568035/020	568036/020
40	O-ring	1	568028/020	568027/020	568031/020	568031/020	568143/020	568039/020
REQUIRED ACCESSORIES								
41**	Setting Tool	1	22709/034	22709/020	22709/008	22709/008	22709/031	22709/051
42**	Setting Tool	1	22709/025	22709/075				
43**	Service Kit	1	155463/005	155463/005	155463/005	155463/005	155463/005	155463/005
EXTRA								
44 * **	O-ring Packing Set		155893/010	153860/010	155323/010	155323/010	156244/010	155324/010
45 * **	Coiled Tubing Jar Oil		154549	154549	154549	154549	154549	154549

* Recommended Spare Parts

** Items not shown in the Tool Illustration

† Specify Thread

†† Specify OD

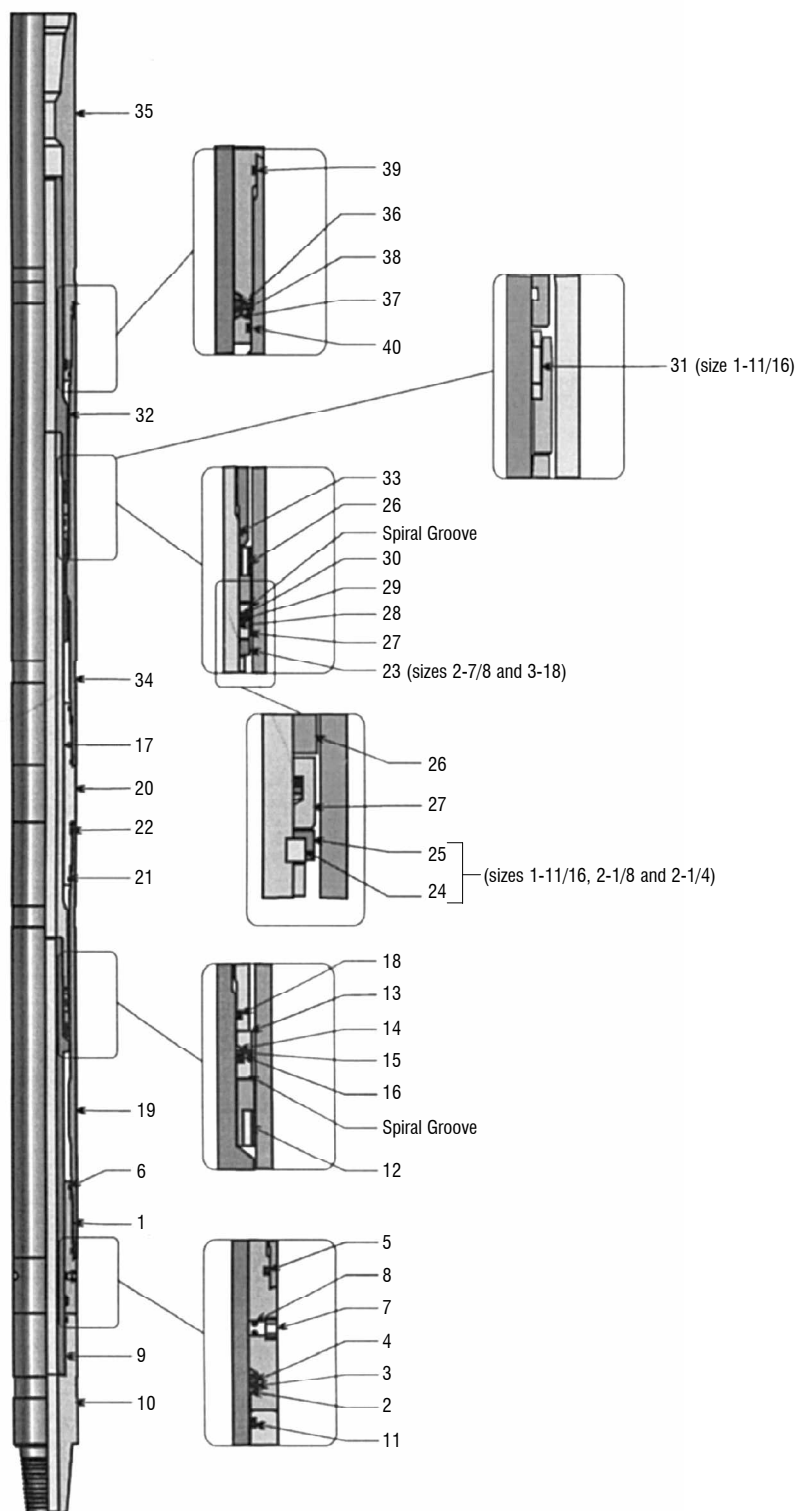


Figure 12.1
Coiled Tubing Jar Parts Numbered

Section 13: Coiled Tubing Jar Service Kit

A **Service Kit** is necessary to properly service the Jar. Because these Kits are identical for every size of Coiled Tubing Jar, a single kit may be used for all Jars at a particular site. The Kit does not include any Seal Setting Tools, which are required for each size of Jar. These setting tools must be ordered separately. They are usually stored in the Service Kit metal box. The Service Kit can also be used to service the Coiled Tubing Intensifier if the tank and hoses are purged of Jar oil, cleaned and refilled with clean Bowen Intensifier Fluid.

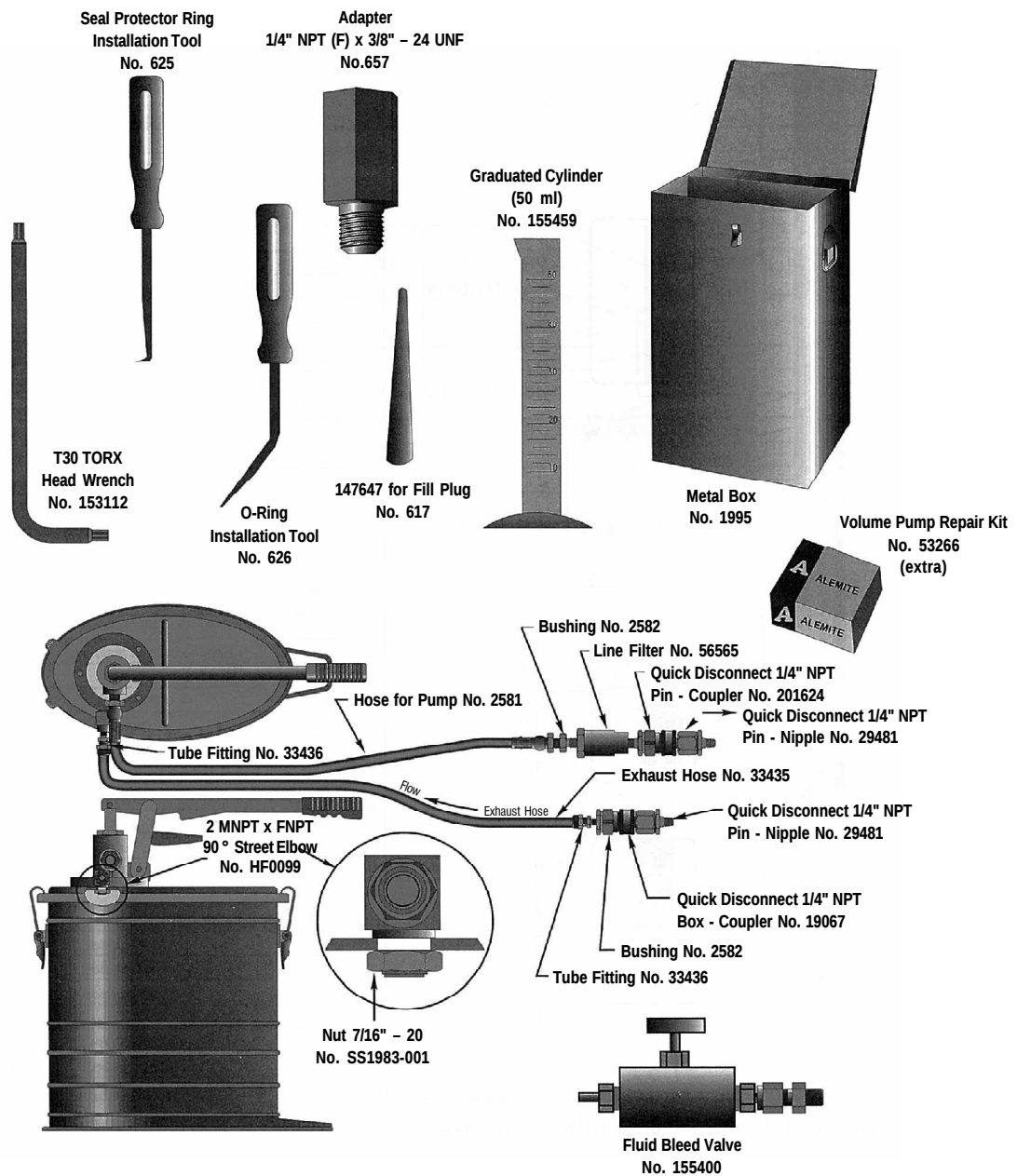


Figure 13.1
Coiled Tubing Jar Service Kit

Corporate Headquarters

10000 Richmond Avenue
Houston, Texas 77042
United States
Phone: 713 346 7500
Fax: 713 346 4493

Alaska
4111 Ingra
Anchorage, Alaska 99503
United States
Phone: 907 563 5253
Fax: 907 561 0071

California
4117 Atlas Court
Bakersfield, California 99308
United States
Phone: 661 395 0165
Fax: 661 328 1827

Louisiana
108 Nova Drive
Broussard, Louisiana 70518
United States
Phone: 337 839 2400
Fax: 337 839 2211

190 Thompson Road
Houma, Louisiana 70363
United States
Phone: 985 851 1111
Fax: 985 851 1117

Mississippi
2930 Industrial Blvd.
Laurel, Mississippi 39440
United States
Phone: 601 649 8671
Fax: 601 649 8673

New Mexico
#14 CR 5860
Farmington, New Mexico 87401
United States
Phone: 505 326 4303
Fax: 505 326 4304

North Dakota
3202 1st Avenue West
Williston, North Dakota 58801
United States
Phone: 701 774 0091
Fax: 701 774 0092

Oklahoma
3800 Thomas Road
Oklahoma City, Oklahoma 73179
United States
Phone: 405 677 2484
Toll Free: 877 760 1711
Fax: 405 677 2457

Texas
1249 Commerce Road
Alice, Texas 78332
United States
Phone: 361 664 8013
Fax: 361 664 0462

8411 Irvington Boulevard*
Houston, Texas 77022
United States
Phone: 713 691 7800
Fax: 713 691 7807

2810 Highway 135 North
Kilgore, Texas 75662
United States
Phone: 903 984 2553
Fax: 903 984 7170

10720 West I-20 East
Odessa, Texas 79765
United States
Phone: 432 563 1173
Fax: 432 563 1182

30444 Southwest Freeway
Rosenberg, Texas 77471
United States
Phone: 281 341 5365
Fax: 281 344 1986

Utah
1553 East Highway 40
Vernal, Utah 84078
United States
Phone: 435 789 0670
Fax: 435 789 6568

West Virginia
Route 2, Murphy Run Road
Clarksburg, West Virginia 26301
United States
Phone: 304 622 4303
Fax: 304 623 2174

Wyoming
1283 N. Derrick Drive
Unit 1, Box 2
Casper, Wyoming 82604
United States
Phone: 307 237 3100
Fax: 307 237 2546

Canada
9120 – 34A Avenue
Edmonton, Alberta T6E 5P4
Canada
Phone: 780 702 5209
Fax: 780 463 2348

3550 93 Street*
Edmonton, Alberta T6E 5N3
Canada
Phone: 780 944 3929
Fax: 780 430 0760

1100 540 5th Avenue SW (Mailing)
1010 540 5th Avenue SW (Office)
Calgary, Alberta T2P 0M2
Canada
Phone: 403 250 8000
Fax: 403 294 5790

England
2 Isbourne Way
Winchcombe
Cheltenham
Glos, GL54 5NS
England
Phone: 44 (0) 1242 603975
Fax: 44(0) 1242 602614

Dubai
Nr. R/A 13, Daimler Chrysler Street
P.O. Box 61490
Jebel Ali Free Zone
Dubai
UAE
Phone: 971 4 8838776
Fax: 971 4 8838795

Indonesia
Cilandak Commercial Estate Unit 105
Jl. Raya Cilandak KKO
P.O. Box 7541
Jakarta, 12560
Indonesia
Phone: 62 21 782 6088
Fax: 62 21 782 6086

Scotland
10 Kirkton Avenue
Pitmedden Road Industrial Estate
Dyce, Aberdeen AB21 0BF
Scotland
Phone: 441 224 334800
Fax: 441 224 723034

Singapore
9 Tuas Avenue 5
Singapore, 639335
Singapore
Phone: 65 68611566
Fax: 65 68610728

Germany
Edesser Straße 1
31234 Edemissen Berkhöpen
Postfach 31232
Germany
Phone: 49 5176 97670
Fax: 49 5176 9767 22

* Denotes Manufacturing and Engineering facilities

Downhole Solutions

Drilling Solutions

Engineering and Project Management Solutions

Lifting and Handling Solutions

Production Solutions

Supply Chain Solutions

Tubular and Corrosion Control Solutions

Well Service and Completion Solutions